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Introduction and Evaluation of Pot Charcoal Chicken Brooder Applicable to Remote and Rural Areas

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Abstract: An experimental chicken brooder technology trial was made by using charcoal as heat source at the University of Gondar teaching and research poultry farm, Ethiopia, on sixty day-old chickens with the aim of producing an alternative chicken brooder which is applicable in rural areas by determining survival of chickens. The sixty day-old chickens were randomly allocated into three groups: first group (n=20) brooded under pot charcoal candidate brooder, second group (n=20) brooded under electrical brooder (DI/QC/M/107 EXPO $^{OFF®}$, India) which can produce 250 watt (positive control) and the last group (n=20) was kept in brooder guard for negative control. All groups of the chicken were strictly followed throughout 24hours for 15 days and number of death of chickens was recorded. The candidate pot charcoal brooder showed higher level chicken survival than that of the modern positive control brooder. Death rate was high during the night time. In conclusion, higher level of chickens' survival comparable to conventional electrical brooder was observed by the pot charcoal brooder; this together with working in areas where there is no electricity supply make the pot charcoal brooder applicable to achieve poultry extension plan in rural areas. However, further experimental trial by measuring the amount of heat it produces per unit volume of charcoal, the factors affecting and its impact on forest in the different seasons of the year was suggested.

Key words: Brooder % Charcoal % Chicken % Ethiopia % Gondar

INTRODUCTION

Poultry is the largest livestock species worldwide [1] and is attractive in the context of poverty alleviation and quality protein supply. It has a high reproduction rate per unit time, requires a very low capital investment and space, hence, poultry can be kept even by landless families [2].

In Ethiopia, chickens play an important role in the diet and economy of the country [3]. Currently, substantial increase in the demand for milk and meat due to increasing human population and urbanization [4] and poor performance of local chickens [5] are leading to a substantial increase in keeping improved breeds [6]. Despite their high level of production, however, improved breeds are capital intensive; unaffordable by rural poor farmers. In this regard, poultry development strategy has been launched to assist rural poor farmers by supplying day-old-chickens of high-grade exotic breeds and results in emergence of a number of small scale poultry farms in the country [5]. However, lack of facilities including lack of temperature regulation impact the extension activity; about 60 % of the chickens hatched in the rural area of Ethiopia die during the first eight weeks of their life [7]. The day-old chickens require external heating to survive and grow, as they have not yet developed feathers and cannot regulate their own body temperature. Brooder is used to imitate the warmth and protection like a mother hen gives her chickens. However, this modern device is not applicable in rural areas, cold places and remote hilly

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regions of Ethiopia where there is no electricity while poultry farming is significantly increasing at present and in the years to come. To overcome these problems and the poultry extension plan to succeed, developing appropriate technology applicable to such areas is a must, not a necessity. Therefore, this investigation was carried out in order to evaluate pot charcoal chicken brooder applicable to remote and rural areas using charcoal as heat source by determining survival of chickens.

MATERIALS AND METHODS

Study Area and Experimental Animals: Experimental study was conducted from 1 to 15 May, 2011 at the University of Gondar teaching and research poultry farm, Ethiopia. In the area where the teaching and research poultry farm is found, mean annual rainfall and mean average temperature of 1172mm and 19.7°C is recorded, respectively; the area has altitude of 2220 meters above sea level [8]. However, range of temperature of 12 to 32°C was recorded during the experiment. Sixty commercial Rhode Island Red strain day-old chickens were used for the experiment.

Preparation of Test Chicken Brooder: The pot charcoal candidate brooder was used in the present experiment to brood chickens. The pot was made of mud and purchased from local pottery people (Fig 1). The inner cylinder of the pot had 28cm length and 25 cm diameter. It had been built in a way that it has 35 to 45 holes on the sides to avoid smoking by allowing entrance of oxygen and for heat exit. One cubic meter (approximately 120kg) wood charcoal

Fig. 1: Pots made of mud

was used as burning material to generate heat throughout the experiment. Wood charcoal was added to half of the volume of the pot, set to fire and let to generate constant heat for an hour; the pot was then constantly filled with charcoal in an hour interval to keep is volume in the pot. Another similar pot devoid of charcoal was overlapped mouth-to-mouth for the purpose of retaining heat and flames of fire, before it had been put at the center of brooder guard where test chickens were controlled. The pot charcoal was able to warm the chickens' environment up to 1.5meters from it, however, chickens reached at the border during the day light hours when the environment was warm; otherwise they pile close to the heat source. The heated pot radiates heat and makes the environment around warm. A commercial electrical brooder (DI/QC/M/107 EXPO $^{OFF®}$, India) was used as positive control.

Experimental Protocol: The sixty day-old chickens were randomly assigned into three groups: first group (n=20) brooded under pot charcoal candidate brooder, second

Table 1: Number and time of death of dead chickens within 15 days of the brooding experiment

			Time of death	
Brooder used	No. of test chickens	Deaths (%)	Day (%)	Night (%)
Pot charcoal candidate brooder	20	-	-	-
Positive control electrical brooder	20	2 (10)	-	2 (10)
Negative control	20	6 (30)	1 (5)	5 (25)
Total	60	8 (13.3)	1 (1.7)	7 (11.7)

Table 2: Number of dead and survive chickens in each of the 15 follow-up days of the experiment

		Follow-up days														
Brooder used	Chickens at the start	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Pot charcoal	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Positive control	20	20	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Negative control	20	20	15	14	14	14	14	14	14	14	14	14	14	14	14	14
Total	60	60	53	52	52	52	52	52	52	52	52	52	52	52	52	52

group (n=20) brooded electrical brooder of 250 watt capacity (DI/QC/M/107 EXPO OFF®, India) (positive control). In both brooders, brooder guard was used to control each group of the chickens; while the rest (n=20) were kept only in brooder guard for negative control. All the three group of chickens brooded under similar management conditions. Equal quantity of rice bran distributed with depth of 7-8 cm was used as litter in each of the brooder guards. Finally, chickens were strictly followed throughout 24 hours for 15 days and death/survival of chickens was recorded.

RESULTS

There was no any death of the chickens brood by the pot charcoal test brooder compared to that of chicken brooded by positive control commercial electrical brooder (DI/QC/M/107 EXPO OFF®, India); 2(10%) of the chicken brooded in the latter were died. Six (30%) of the chicken kept to brood without brooder (negative control) were died (Table 1).

The death/survival of the chickens was seriously followed throughout the 24hours for 15 days and highest number of death, 7(87.5%) was recorded on the second day of the experiment (Table 2).

DISCUSSION

No death of chickens was recorded in the pot charcoal brooder compared to that of the conventional electrical brooder and to that of the negative control (30% death was recorded). The result in this study was in agreement with the work of Chaurasia *et al*. [9] who reported *Bukhari* (an apparatus which uses charcoal as burning material and indigenously used as room heaters, cooking mantles, etc. by inhabitants of high altitude experiencing medium to extreme cold weather in India) being equally efficient to conventional brooder in their work of *Bukhari*-an indigenous method of brooding in remote and rural areas of India. Similarly Awudu *et al*. reported that the "Awudu heater" (a heater runs on wood charcoal) is a simple indigenous contrivance equally efficient to electric heaters [10]. Abbey [11] described that charcoal briquettes give a stronger and more stable heat. In our experiment, even though the heat generated varies depending on the amount of charcoal, we have observed that it is possible to generate required amount of heat to keep the chickens' environment warm enough. However, Hassanuzzaman *et al*. reported that charcoal brooders did not perform well in generating heat necessary for brooding [12].

The differences and similarities between the current and previous studies might be associated with the nature and amount of charcoal, the materials used to contain the charcoal and the way it radiates or dissipates the heat. It can also be associated with the conventional brooder used for comparison, the number of chickens brooded per brooder and the environmental temperature and humidity. According to Damerow [13], chickens need auxiliary heat longer than chickens brooded in warmer weather.

The 10% death recorded in chickens brooded by the positive control electrical brooder (DI/QC/M/107 EXPO OFF®, India) is associated with the power interruptions occurred during the experiment. Higher number of death of chickens, seven of the 8 (87.5%) occurred during the night compared to the death (12.5%) occurred during the day light hours and highest number of death recorded on the second and third days of life of chickens; indicated that external heat is more important for survival and growth of day-old chickens during the night cold hours and following hatching when they are very young than when they are getting old. Smothering of chickens usually occurs at night when the temperature drops and chickens require less heat as they get older [13]. In conclusion, higher level of chickens' survival comparable to conventional electrical brooder was observed by pot charcoal brooder; this together with working in areas where there is no electricity supply make the pot charcoal brooder applicable to achieve poultry extension plan in rural areas. However, further experimental trial by measuring the amount of heat it produces per unit volume of charcoal, the factors affecting and its impact on forest in the different seasons of the year is suggested.

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